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15 FEBRUARY 1989



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# **Science & Technology**

***CHINA: Energy***

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# Science & Technology

## China: Energy

JPRS-CEN-89-002

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### **Rough Road Ahead Predicted for Nation's Energy Development**

40130058 Beijing BEIJING KEJI BAO in Chinese  
9 Nov 88 p 3

[Article by Wei Zongqi [7614 1350 3825], Senior Engineer, Chinese Society of Energy Research]

[Text] For the projected quadrupling of gross output value of agriculture and industry for the nation in the period 1980-2000, there will be only a doubling of energy production. How can this be done? Specialists are calling for implementation of every possible method of energy conservation.

China's energy resources are relatively abundant, occupying an important position in the world. China is also a major energy consumer ranking third worldwide. During the Sixth and Seventh Five-Year Plans, China's energy industry has achieved a great deal and has steadily made obvious contributions to sustaining the national economy. In spite of this, we still cannot be blindly optimistic regarding China's energy prospects.

#### **1. China's energy situation must be accurately assessed.**

At present and for a very long period into the future the serious energy situation will persist and will be a continuous limiting factor in the development of China's national economy. This is due to the following:

1) Although China's energy resources are abundant, because its population is large, per capita energy resources are very small, only one-half the world standard. Even more important factors in the pessimistic energy outlook are the uneven distribution of resources, a lack of sophistication in exploration and the limited amount of high-quality resources.

Let us take coal as an example. Coal is China's major energy source. Based on verified reserves, north China has two-thirds of the country's deposits, with Shanxi alone accounting for about one-third, while the eight provinces south of the Chang Jiang only have 2 percent. Distribution is very uneven. National long-term reserves are estimated to be 5 trillion tons; verified reserves total 780 billion tons of which 241 billion tons have been precisely calculated. Of this 241 billion tons, 179.8 billion tons are being developed and only 61.2 billion tons are as yet unexploited. Only 30 billion tons of this unexploited amount can be mined. Based on a 50 percent recovery rate and a 70-year mining plan, 30 billion tons could only provide new mines with annual production capacity of about 200 million tons. This is not a very significant advantage. Moreover, expansion of coal production is affected by transportation and environmental limitations. Other forms of energy such as petroleum and natural gas are not plentiful and the prospects are not bright. Hydropower resources, while abundant, are difficult to exploit.

2) China's overall energy consumption ranks third in the world, however, per capital consumption is very low. National per capita energy consumption in 1987 was only the equivalent of 795 kilograms of coal, only one-third of the world average. In the developed countries per capita consumption was 8,000 to 10,000 kilowatt-hours, while in China it was only 450 kilowatt-hours. Urban residents averaged only 35 kilowatt-hours. This represents only 1 percent of the average for the United States. In rural areas 40 percent of residents (about 300 million people) still do not use electricity.

3) In China, energy has long been in short supply with especially serious shortages existing in electric power and petroleum products.

At present, there is a nationwide shortage of 70 billion kilowatt-hours and 10 million tons of petroleum products. Coal supplies rely heavily on expansion of village and town coal mine production. This year the situation has become even tighter. Rural area power shortages are even more serious with 75 percent reliance on biological materials as fuel for daily living. The commercial power supply is very small. Taking electric power as an example, because it has long been in short supply (beginning in 1970), the shortage has steadily increased, the area affected has steadily expanded and 80 percent of the generating units cannot be overhauled. Therefore, electric power generating facilities operate under excessive load and frequent power shortages occur. This is difficult to alleviate in the short-term. According to estimates, in the year 2000 there will still be a relatively large shortfall.

4) China's per capita energy consumption is low while its energy consumption per unit of output value is high. For example, in 1987, China's energy consumption per unit of output value was about 2.93 kilograms of standard coal per U.S. dollar, while that for the United States, Japan and India was 0.71, 0.41 and 1.00 kilograms of standard coal per U.S. dollar respectively. In other words, if China and India were to expend an equal amount of energy, the output value created by India would be three times that of China. Because energy utilization efficiency is low, some experts consider China to be perhaps the world's greatest waster of energy.

The two aspects of tight supply and serious waste have determined the long-term nature of the energy problem in China. In other words, China will face a long-term energy problem.

#### **2. Conservation is a practical and effective method for solving China's energy problem.**

China has three ways of solving its energy problem. The first is increasing energy production from conventional sources. The second is development of new energy sources and the third is to work at energy conservation. In actuality, rapid, large-scale increases in energy production are very difficult to achieve and new energy

sources could not have any obvious impact in the short-term. Therefore, the various methods of energy conservation have become China's most effective and practical way to the solution of its energy problem.

Poor long-term management and backward technology have caused serious waste in energy utilization. This serious waste provides us with very great potential for energy conservation. Worthy of note is the fact that, in the past one or two years, energy conservation work has been on a downward trend. Some organizations and leaders are wholly focused on their own short-term economic returns while neglecting national energy conservation work beneficial over the long-term.

3. Concepts should be changed and management systems reformed to transform enterprises into the principal agencies of energy conservation.

Enterprises are the principal agencies of energy consumption and 100 percent of energy production comes from enterprises. Nationwide, over 70 percent of the energy is consumed by enterprises. However, China's energy conservation work has long been of the rigidly planned model, with the government as its primary agency. Implementation of conservation work was primarily decided by policies, orders and direct intervention of all levels of government in enterprises (e.g., energy conservation targets, statistical reporting, funding and escalation of conservation by enterprises). In the future, the enterprises should become the principal agencies of energy conservation. National management of energy conservation also must gradually move from an emphasis on the use of administrative direct intervention toward reliance on the laws of a commodity economy, the primary use of economic methods (e.g., policy, pricing, taxation, credit, and incentives) and legal methods (e.g., rules and regulations) to lead the enterprises in the independent realization of conservation objectives. The primary role of all levels of government is to formulate good conservation policies and programs, to coordinate and supervise, to provide feedback and to carry out other macroscopic management and service work. Realization of this change will allow energy conservation work to genuinely create a new situation.

4. Adjustment of energy pricing should not be delayed.

Many facts indicate that irrational pricing is a major factor in creating waste in the energy development, utilization, distribution, transportation and investment cycles. Raising energy prices would both be in accord with the laws of a commodity economy and would further the conservation of energy. It is also, for the short to mid-term, the most effective policy method for eliminating energy restrictions. Therefore, at present it is most important that we extract from general economic reform, particularly the overall demands of price and wage reform, a policy for energy pricing revision as soon

as possible. An immediate increase in industrial electric power prices and a temporary maintenance of current pricing for electricity used by the people can be considered.

5. Work on formulation of energy conservation methods should begin as soon as possible.

Many countries worldwide, including the developed countries (e.g., the United States and Japan) and the developing countries (e.g., India) have a legal basis for their energy conservation work and this has proved very useful. Worthwhile lessons can be learned from this. China is one of very few countries which do not have formal energy and energy conservation laws. Moreover, no such laws have been included in the series of legislation pertaining to the national economy. Energy conservation is an enormous, integrated system project. Therefore, it is necessary to organically integrate administrative, economic and legal methods and gradually move to a position where law is the dominant factor in the leading, organizing and managing of energy conservation work. Energy conservation laws which employ the coercive power of the State to guarantee the realization of the best economic returns and energy conservation results must be adopted.

6. Much emphasis must be placed on the solution of power shortage problems in coastal areas.

China's coastal regions have long been experiencing serious power shortages. Rapid economic development will certainly lead to rapid expansion of power consumption and will exacerbate the coastal power supply and demand contradiction. According to initial forecasts, by the year 2000, the 12 coastal provinces will face particularly large power shortages. This serious situation requires full attention. The following is suggested: 1) Establish an open-style power supply-and-demand system. Each coastal province must first forecast the energy supply-and-demand situation and formulate programs and development strategies. Keeping in mind internal and external markets, they should set up their own open-style power supply and demand systems. Those areas with excess power production can export to neighboring areas, while those areas with inadequate supplies can import from close by. This can both solve the supply and demand contradiction and ease energy transportation pressure. 2) Cut back power intensive industries and develop those manufacturing industries which consume less power, e.g., light industry and textiles, food, electronics, and machinery, thus expanding exports and reducing power consumption. 3) In the short term, development of steam generation is no doubt most feasible. However, major measures for the solution of coal transportation and pollution reduction problems must be considered. 4) Based upon new Chinese and international developments in energy technology and on practical conditions, new "short-term, widely applicable, and fast" methods should be adopted to alleviate the fuel coal crisis, for example, construction of oil and gas-fired

power plants and "deep-pool heat supply piles," and new ways in which to exploit nuclear power in accordance with national circumstances.

**Power Shortage, Now Acute, Expected to Worsen**  
*40130055a Beijing Domestic Service in Mandarin*  
2230 GMT 18 Dec 88

[Text] A spokesman for the Ministry of Energy recently stated in Beijing that the increasingly sharpening contradiction between energy supply and demand is already affecting China's economic growth as a whole.

He said: This year it has been common for industrial enterprises to suspend production because of power shortage. Even Northwest China, which had no power shortage in the past, experienced one this year.

The spokesman predicted that the power shortage will worsen this winter and next spring.

He reported that China's energy production continues to grow this year as in the past. During the January-November period, the quota for coal output was exceeded by 28.36 million metric tons, and that for power output by nearly 8 billion kWh, and that crude oil output reached 120 million metric tons. Meanwhile, railway departments also exceeded their coal transportation targets. However, the nation's energy supply and demand problem remains acute despite these circumstances.

The spokesman said: The fundamental cause of this situation lies primarily in the failure of effectively controlling the overheated economic growth. Over the past 3 years, China's power output has been increasing by around 10 percent, which is uncommon in any other country in the world. However, the nation's industrial growth in the past several years has far exceeded the growth of power output. Inadequate coal transport facilities and inefficient energy utilization are also major causes of the energy shortage.

He reported that the Ministry of Energy has drawn up a plan to alleviate the problem of energy shortage. Measures under the plan include building power plants close to mining areas. Although these plants have to deliver power to consumers over a long distance, they do not have to depend on the availability of transportation. Meanwhile, great efforts will be made to utilize geothermal energy, build more medium-sized hydroelectric power stations, and construct large, energy-efficient power generators to replace small, energy-inefficient ones.

**Heilongjiang Faces Deteriorating Power Supply Situation**  
*40130059a Harbin Heilongjiang Provincial Service in Mandarin* 2200 GMT 18 Jan 89

[Text] A shortage of electricity supplies in Heilongjiang caused by the low water in reservoirs and strained transportation of coal will be aggravated rather than

alleviated before the end of May this year. Pertinent departments stressed that implementation of the measures to sort out power consuming projects and to plan and economize power consumption should be facilitated.

As was learned from the provincial power work conference held on 18 January, our province lacks 1.8 million tons of coal needed to fulfill its mandatory power generation quota and guidance power generation quota reserved for a new generating unit to be installed, and to carry out the processing work that could not be done due to coal shortages. It lacks 350,000 tons of fuel oil needed to maintain the normal operation of power plants.

Except for the Shuangyashan power plant, 10 power plants in Heilongjiang are located far from coal mines. In the current nationwide strained situation in transportation, delivery of coal for power generation has become a difficulty that should be resolved urgently. The weak structure of the power grid threatens its stable operation. If automatic safety equipment is not strengthened in a timely manner, the possibility of a collapse of the power grid will be constant. Our province's current capacity to make adjustments for power consumption peak is only 500,000 kilowatts. Making adjustments for peak power consumption has become an increasingly serious problem.

Capital construction for the power industry is also faced with shortages of funds and materials. For this reason, power departments in our province should upgrade their managerial as well as scientific and technological levels, enhance the sense of fixing power supply quotas according to coal supply, abandon the idea of above-capacity power generation, and pay attention to safety in generating and supplying power.

The principle of settling limits on power consumption in a planned manner should be implemented, the power consumption structure should be adjusted, and power consuming projects should be sorted out with determined efforts. Meanwhile, management of the power plants operated by local authorities and enterprises should be strengthened, and they should be organized to generate more power. We should launch large-scale mass activities of power conservation and increase the effective supply of power.

**New Power Group Invests in Energy Projects**  
*40100029b Beijing CHINA DAILY in English*  
26 Jan 89 p 2

[Article by staff reporter]

[Text] The China Huaneng Group, which celebrated its official inauguration on Tuesday, has already invested 20 billion yuan and \$2.4 billion in 260 projects.

Wang Chuanjian, president of the group, said the projects include power plants with a capacity of 18 million kilowatts, coal mines with a production capacity of 38 million tons and 170 kilometres of railways.

Wang said that the central task of the group's 15 subsidiary companies will be the production of electricity. Huaneng is charged with the development of the energy, transportation, and raw materials industries.

Wang said the power industry is still a major hurdle in the development of the national economy. The Huaneng group will build more pit-mouth power plants, medium-sized hydroelectric power stations, and nuclear power plants in China's coastal areas.

Huaneng's investment mainly comes from the special funds generated by "replacing oil with coal," an energy-saving principle put forward by Zhao Ziyang in 1981.

The State Council called on the power industry to upgrade some oil-burning power plants to coal-burning ones to save 20 million tons of oil in 10 years for export. The foreign exchange earned from these oil exports would then be invested in the development of China's energy industry and transport facilities.

Huang Yicheng, energy minister, said Huaneng has earned about \$3 billion over the past few years and has paved the way for saving more oil.

#### November Energy Figures Released

40130050a Beijing CEI Database in English 27 Dec 88

[Text] Beijing (CEI)—Following is a chart of China's total output of primary energy production in November 1988, released by CSICSC [China Statistics Information Consultancy Service Center]:

Item	Unit	1-11/88	11/88	percentage over 1-11/1987
Total Output (10,000 tons of standard coal)	—	84415.0	8065.0	104.60
a. raw coal	10,000 tons	85149.0	8300.0	105.10
including: output under unified central planning	10,000 tons	40770.0	3767.0	103.00
b. crude oil	10,000 tons	12469.5	1161.8	101.90
c. natural gas	100 million cubic meters	130.4	11.8	101.10
d. hydropower	100 million kWh	1002.9	79.4	109.70

**Nation to Reform Power Management System**  
40130050b Beijing XINHUA in English  
1547 GMT 15 Dec 88

[Text] Beijing, December 15 (XINHUA)—China's Energy Ministry today announced [its intention] to reform the country's power management system so as to promote power development and alleviate the national power problem as soon as possible.

Shi Dazhen, vice minister of the energy ministry, said at the national conference on power management system reform opened here today that China's present interprovincial power network management system will be changed into unified network management system with provincial network as independent economic entity.

He said that the existed provincial power management bureaus will be correspondingly changed into power companies and interprovincial power network administrative bureaus will be changed into unified power corporations.

The past years have witnessed a rapid development in China's power industry. Five large interprovincial power networks have been established, which have exerted very effective role in power transport and dispatch.

However, development of the national economy has brought a dramatic increase in the country's power supply. Problems in the present power management system, such as unreasonably low prices and uncertain guarantees of the rights and benefits of local departments which have invested in power development, have all hindered the overall development of the nation's power industry.

According to the vice minister, the reform is aimed at clearing all these obstacles. Measures will be taken to ensure the rights and benefits of the investors through policies; various responsibility systems will be implemented to closely link up the interests of workers and development of power industry.

He said, from now on, newly built power plants will all be economically independent and rational prices will be fixed to enable them to make profits. And prices for power to be sent to networks will be varied according to the time it is generated so that they will be rational.

He asked the entire reform work be completed before the end of June 1990. Today the East China network, chosen for experiment, has finished its reform and will soon be operated under a new system.

**Over 10,000 MW in Generator Capacity Added in '88**

40100026b Beijing CEI Database in English 11 Jan 89

[Text] Beijing (CEI)—Power generating units with a combined capacity of 10.51 million kilowatts went into operation in China last year, according to the Ministry of Energy Resources here on 10 January.

Among them were 60 large and medium-sized ones with a total generating capacity of 8.99 million kilowatts.

These newly operated generating units produced 14.05 billion kWh electricity in 1988, according to the ministry.

Last year, the ministry also erected 11,481 kilometers of power transmission lines and built transformer substations with a combined capacity of 19.58 million kVA.

An official from the ministry said that various localities and enterprises added more power stations with an aggregate generating capacity of 373,000 kilowatts last year.

**Changchun Struggles Under Worsening Energy Crunch**

40130040 Changchun JILIN RIBAO in Chinese  
10 Nov 88 p 1

[Text] Recently, the residents of Changchun City have been experiencing frequent electric power rationing. In places, this occurs from 3 or 4 times a week to a maximum of 5 or 6 times a week, creating difficulty for enterprise production and inconvenience for the people. Why is the electric power supply so tight? Can the shortage be alleviated soon? This reporter interviewed the head of the Electric Utilities Office, asking him to discuss the electric power supply situation in the city. He said that this year's power shortage is the worst in history.

From January through September, 77.7 percent of the year's planned power generation had been completed. This represents an increase of 3.79 billion kilowatt-hours or 7.1 percent over the same period last year. This being the case, why was electricity in such short supply? He then stated the major reasons: First, hydroelectric power generation has decreased. The five large reservoirs of Baishan, Fengman, Yunfeng, Shuifeng and Huanren have encountered a drought that occurs only once in 50 years. Water levels have fallen to their lowest levels in many years. Second, the planned shipments of coal had not arrived and fuel was in very short supply. For the period of January through September, the power grid was short by 1.4 million tons of coal. Compared with the same period of 1987, coal stockpiles were down by 700,000 tons. Third, electric power loads have increased exceptionally rapidly, exacerbating the contradiction between supply and demand. Fourth, the amount of electricity used in daily living has increased very rapidly.



For the period January through September, over the entire grid, there was a 25.79 percent increase in consumption for daily living as compared with the same period last year. This causes the year's electric power consumption target to be 854,000 kilowatt-hours, or 11.5 percent less than for the same period last year. The actual usable power is 1.22 million kilowatt-hours, or 15.8 percent less than for the same period last year. When the increases are factored in, supply falls short of demand by 200,000 kilowatt-hours per month, an unprecedented shortage of 23.5 percent. Entering February, heating and lighting peak loads gradually increase and the power supply situation becomes even more critical.

What can be done? At the present stage, planned rationing is the only alternative. The municipal government must control industrial and business use of power, and guarantee consumer goods production and power used in daily living. Supplies of power to railroads, airports, waterworks, coal gas facilities, trolleys, communications, and broadcasting and television must be assured. Some of the power used by colleges, universities, and scientific research institutes must also be guaranteed. Each district has adopted a rotating method of power cut-offs. Monday through Thursday of each week, power will be cut off to the Chaoyang district. Kuancheng will be cut off on Monday, Thursday, Friday, and Saturday; Nanmei on Tuesday, Thursday, Friday, and Saturday; and Erdaohezi on Monday, Tuesday, Friday, and Saturday.

The Electric Utilities Office manager said that they receive phone calls or letters every day asking why power to some area is never cut off, while power to another is always being interrupted. Is it that the power rationing is not equitable? He explained that this is due to inadequate understanding of power lines on the part of the people. Rationing of power is based on the nature of the consumers on the line. Overall, the municipality has 132 lines. At present, supply to 57 of these must be guaranteed. Virtually all of Changchun's power lines are integrated, with business and residential power use intermixed on the same line. If one is cut off, all are cut off,

if supply flows to one, it flows to all. Assuring supply to one organization, in effect, means assuring an entire line. Therefore, residents on such a line can access the power. We can only say that this is not very rational; we cannot say it is unfair. Moreover, this is not artificial. Rationing of power is definitely not based on where officials live and where the people live. On the contrary, it is implemented according to a previously worked out and approved plan. No person has the authority to arbitrarily cut off power. For example, our Electric Power Bureau has six dormitory districts where staff and workers are concentrated. Except for those on the line which supplies the Provincial Power Dispatch Center, which does not experience cut-offs, power is rationed to all others in accord with regulations.

Are we helpless in the face of such a power supply shortage? According to the manager, not at all. The Municipal Party Committee and the Municipal Government place great emphasis on solution of the power shortage problem. Over the past few days both the Party Secretary and the Mayor have been personally trying to locate coal and residual oil. Some 2,000 tons of residual oil and 12,000 tons of coal have been obtained, which will yield 500,000 kilowatt-hours. Concurrently, fines for excessive use of power have been adopted, as has control of late peak consumption and strict limitation of decorative, neon, and colored lighting utilization. Use of non-industrial electric heat, residential electric cooking utensils, hotel and restaurant climate control, electric water heaters, etc., will, without exception be stopped. Activities to thwart power theft have been initiated. In the city, 200 people have been transferred to implementation of power line monitoring, protection and management measures to alleviate the power shortage.

**Jilin Overfulfills Power Generation Target**  
40130059b Changchun JILIN RIBAO in Chinese  
1 Jan 89 p 2

[Summary] By prefulfilling the 33.8 billion-kWh of the annual power generation target by 12 days, the power industry enterprises in Jilin Province generated an additional 1.14 billion kWh by the end of 1988.

**Official Says Three Gorges Project To Be Delayed 5 Years**

40100029a Hong Kong HONGKONG STANDARD in English 25 Jan 89 p 6

[Article by Tammy Tam]

[Text] A senior official says plans to build the world's largest dam on the Chang Jiang cannot go ahead for at least 5 years, adding another delay to a project that has already undergone 30 years of debate.

"It is impossible to start the Three Gorges hydroelectric project in the next 5 years. So there is no need to waste great efforts to discuss it," Vice-Premier Yao Yilin said at a session of leaders of the National People's Political Consultative Conference (NPPCC).

Mr Yao is director of the co-ordinating group on the project under the State Council. His comment was the first by a top official indicating the massive project faced yet more delay.

Nonetheless, officials of the Three Gorges Project Discussion Group continue to insist the plan should get underway as soon as possible.

"The tenth discussion meeting on Three Gorges will be held in March to finalise feasibility studies that have just been completed by 412 experts," said Mr Tao Jingliang, head of the general office of the group.

The project involves construction of a dam and power station in Xiling Gorge, the easternmost of the three gorges along the Chang Jiang, which flows from Sichuan Province into neighbouring Hebei Province.

"Vice-Premier Yao did not say that the project should not go ahead," said Mr Tao.

"He was just calling a halt to the project. That is different from cancelling the project."

He said the comment reflected efforts to reduce expenditure on construction projects.

Mr Tao's group was set up in June 1986 by the State Council.

"We have done numerous feasibility studies on various aspects in the past 2 years," said Mr Tao.

"After the March meeting, the final report will be submitted to the State Council, which will further submit it to the next session of the National People's Congress for decision."

He said that for technological and economic reasons, "it is better to start the project as soon as possible than delaying it or even cancelling it."

Mr Tao said the group's support for the scheme "was made after 2 1/2 years of thorough investigation on the Yangtze River area by 412 experts in related fields. All the experts, except only 10, have signed their names on the reports.

"Technically, the experts don't think that there are any major obstacles. As for the huge investment, they estimate that as long as half of the investment has been put into the project, that is 180 billion yuan (HK\$360 million), the Three Gorges can have great financial benefits."

He said the power generated by the state would save 40 million tons of coal, worth 4 billion yuan (HK\$18 billion) a year.

Opponents say the dam will cause more problems than it is worth.

They point to the need to resettle more than 3.3 million people and the dangers of erosion. China can likewise not afford the price tag, they say.

"We already have a deficit budget and spiralling inflation. Therefore, the huge investment on the project would only force the bank to issue more notes," said Mr Qiao Peixin, former People's Bank of China vice-president.

**Accelerating Hydropower Development of the Lancang Jiang**

40130035 Beijing SHUILI FADIAN [WATER POWER] in Chinese No 10, 12 Oct 88 pp 3-6

[Article by the Lancang Jiang Basin Comprehensive Development Inspection Group\*: "Suggestions on Accelerating Hydropower and Economic Development in the Lancang Jiang Basin"]

[Excerpts] the Yunnan Provincial People's Government invited the China National Economics Research Society, China Hydroelectric Power Engineering Society, China Energy Research Society, and China Water Conservancy Economic Research Society to arrange for a meeting of the relevant specialists, professors, and reporters with comrades in Yunnan Province from 19 April to 16 May 1988 for a comprehensive inspection of resource conditions in the middle and lower reaches of the Lancang Jiang basin and to discuss strategies and measures for bringing prosperity to the people of Yunnan.

During the inspection period, the Yunnan Provincial Planning Commission and the relevant departments, bureaus, and academic institutions described resource conditions and development plans in the Lancang Jiang basin. During the visit, they were introduced to the economic development situation in Yuxi, Simao, Xishuangbanna, Lincang, Baoshan, Dali, Chuxiong, Kunming, and other prefectures, autonomous prefectures, and cities. They made on-site inspections of six

cascade hydropower dam sites on the Lancang Jiang trunk as well as the Manwan hydropower construction site now being built, the Xi'er hydropower station and Lanping lead and zinc mine which have been completed, the plant site at the Anning phosphorous fertilizer base area, the Kunming sodium tripolyphosphate plant, the Haikou phosphorous mine, and some production and scientific research units which are developing and utilizing forestry and tropical crop resources. The general feeling after the inspection was that Yunnan's special natural geography and environment have provided it with enormous hydropower, mineral, biological, tourism, and other resources. This is especially true of hydropower resources on the Lancang Jiang, a particular advantage. The degree of development and utilization of these resources is very low, however, and most of the regions remain in an impoverished and backward state. Development of Lancang Jiang hydropower resources should be the impetus for comprehensive development of other resources by building a Lancang Jiang economic development zone to convert resource advantages into economic advantages, bring prosperity to western Yunnan, promote the development of Yunnan's economy, and contribute to China's four modernizations drive.

Our main opinions and suggestions are as follows:

#### **I. The Rich Natural Resources of the Lancang Jiang Basin Offer Enormous Advantages for Developing Yunnan's Economy**

[passage omitted] Yunnan's phosphate deposits are among China's three largest. They are buried at shallow depths, are close to communications trunk lines, have concentrated high-quality, rich ores, and are easy to mine. The five provinces of Yunnan, Guizhou, Hubei, Sichuan, and Hunan contain 78 percent of China's total phosphate ore reserves, and these reserves are more concentrated in Yunnan. The Dianchi region alone contains 4.187 billion tons in proven reserves and has 400 million tons with a phosphorous pentoxide content over 30 percent, first place in both indices in China, and more than 80 percent is extractable by open pit mining. Phosphate output in Yunnan was 3.26 million tons in 1987, second place in China. It supplied 24 provinces (and autonomous regions) with 100,000 tons of high concentration phosphate fertilizer output and 32,000 tons of yellow phosphate output, both first place in China. Phosphorous chemical products now are being exported in large amounts to earn foreign exchange.

Yunnan Province has 27.6 billion tons of proven sodium chloride reserves, second place in China, and it is concentrated at Simao and at Anning in Kunming. The Anning salt mine has proven reserves of 13.7 billion tons. It is a huge salt mine with large reserves, stable salt strata, shallow burial, convenient communications, and easy extraction. Potassium chloride reserves of 12.16 million tons have been proven at Jiangcheng, and there are 16.29 million tons of associated potassium chloride in rock salt strata. Its reserves are second in China,

following only Qinghai. Based on the conditions in Yunnan's salt mines, a chlorine alkali industry base area can be built to provide the nation with caustic soda, calcium carbide, polyethyleneglycol, and other chemical industry raw materials and with other chlorine products.

Lead and zinc ores are of high quality and large quantity, relatively concentrated, and have many important associated constituents. Yunnan has reserves of 21.65 million tons, equal to 20 percent of China's total reserves. [passage omitted]

The richest are hydropower resources, with theoretical reserves of 100 million kW, equal to 15.3 percent for all of China. About 70 million kW is available for developing installed generating capacity with a yearly power output of 390 billion kWh, second in China, following only Sichuan. Some 82 percent of Yunnan's developable hydropower resources are located on the Jinsha Jiang, Lancang Jiang, and Nu Jiang, including 32.60 million kW on the trunk of the Jinsha Jiang, 18 million kW on the trunk of the Lancang Jiang, and 10 million kW on the trunk of the Nu Jiang. Comparative analysis of geographical locations, geological conditions, communications conditions, construction scales, and other aspects indicates that it would be best to develop the middle and lower reaches of the Lancang Jiang first.

#### **II. Work on Power First, Integrate Mines and Power, Open Up to the Outside, and Do Comprehensive Development To Convert Resource Advantages Into Economic Advantages**

[passage omitted] All the prefecture, autonomous prefecture, city, and county governments and mines and enterprises visited by the inspection group were unanimous in their feeling that energy resources, capital, and manpower restricted their economic development. From the time the nation was founded until the end of 1987, the total installed generating capacity in Yunnan was 2.34 million kW, including 1.44 million kW in hydropower and 900,000 kW in thermal power, with yearly power output of 9.4 billion kWh. The power grid coverage is sparse, and only eight of Yunnan's 17 prefectures, autonomous prefectures, and cities receive power from the provincial grid. The rest depend on medium- and small-scale hydropower which has unregulated performance for power supplies and a low guarantee rate. There is an acute power shortage within and outside the provincial grid. If electric power were guaranteed, the value of industrial output could grow by one-third to one-half over the present base.

Yunnan's coal resources are concentrated mainly in the east, with an extremely small amount in west Yunnan. The fuel needed for industrial and agricultural production and for daily life comes mainly from firewood. It takes 5 kg of firewood to process 1 kg of tobacco or tea, for example, and 7 kg of firewood to process 1 kg of sugar. The dependence on wood for fuel in combination with deforestation, reclamation, and other things has

resulted in forest cutting far in excess of the amount of growth, and it has decreased the forest coverage rate from 57 percent shortly after the nation was founded to 24 percent now, and it is continuing to drop. Some regions are now experiencing severe soil erosion. At a similar latitude on the globe, that is, from 20 to 25 degrees north latitude, the evolution of Africa's Sahara desert from grassland to desert, the appearance of the Rub al Khali Desert in Saudi Arabia, and other situations are very deserving of concern and borrowing experiences.

Yunnan Province must import grain, and water, fertilizer, and science and technology are the keys to grain self-sufficiency. Increases in unit area yields cannot depend on deforestation to create farmland or expansion of the cultivated area. Yunnan is very rich in water resources, with almost 6,000 m<sup>3</sup> available per capita annually, 2.2 times the national per capita figure of 2,700 m<sup>3</sup>. With good work in environmental protection and development of water lifting for irrigation, the water would be no problem. Fertilizer depends mainly on chemical fertilizer. In the national chemical fertilizer structure, the most prominent thing is the shortage of phosphorous fertilizer. Yunnan also has advantages for developing phosphorous fertilizer. The experts in the inspection group pointed out that "China's hopes for phosphorous fertilizer depend on Yunnan." Integration of Yunnan's cheap hydropower with its high quality and large phosphorous ore resources is very important for developing agriculture in Yunnan and increasing grain output in China.

This makes speedy development of Lancang Jiang's hydropower resources to obtain substantial cheap electric power an important measure. We also should develop medium- and small-scale water conservancy and hydropower on tributaries, with comprehensive planning, selection of optimum projects, and preference to development in areas not covered by power grids to derive comprehensive benefits from water conservancy and hydropower.

The cheap seasonal electricity provided by development of Lancang Jiang hydropower could supplement thermal power, and comprehensive plans based on resource characteristics and high energy consuming products could be drawn up to readjust production deployments and arrange for production of yellow phosphorous, calcium carbide, iron alloys, ferrosilicon, crystal silicon and other industries and agricultural and sideline products which can be processed on a seasonal basis. We also could develop hydropower to prepare for expanding the coverage area of power grids to supply the relevant special and autonomous prefectures in west and south Yunnan, promote development of the commodity economy in minority nationality regions, expand international trade at our boundaries, strengthen nationality unity, and consolidate our defenses along the southwest border.

Development of Lancang Jiang hydropower would create excellent conditions for developing water-borne transportation in the lower reaches, and improvement of the shipping channel below Jinghong could open up a waterway from the Gong He to international waterways and turn it into an international shipping channel in southwest China, which is very important for development of international trade to the southwest.

The principle of "working on power first, integrating mines and power, opening up to the outside, and comprehensive development to convert resource advantages into economic advantages" proposed by Yunnan Province, particularly the focus on development of hydropower in the middle and lower reaches of the Lancang Jiang, shows foresight and sagacity, and is extremely correct.

In 1985 Yunnan Province and the former Ministry of Water Resources and Electric Power made a joint investment to build the Manwan hydropower station on the Lancang Jiang. Based on the proportion of investments, the cheap electric power Yunnan obtains will be used for phosphate fertilizer production at Caopu in Anning by enabling construction of a 180,000-ton yellow phosphorous and 1.20 million-ton heavy calcium project in another step toward working on power first, integrating mining and power, and integrating the chemical and power industries, thereby killing two birds with one stone. In the future, part of the income from mining and chemicals can be reinvested in hydropower construction to achieve rolling development of mines and power and of chemicals and power, in a benign cycle.

In summary, the significance of developing Lancang Jiang hydropower as a source of momentum to promote economic construction in western Yunnan is certainly not limited to a single region or a single province, but instead will profoundly affect the deployment of the forces of production in all of China. Recently, officials from the Ministry of Energy, State Energy Investment Corporation, Guangdong Province, and Yunnan Province embodied the principle of "mutual interest and mutual benefit, joint development" by reaching agreement on cooperative development of Yunnan's energy resources, including cascade hydropower stations on the middle and lower reaches of the Lancang Jiang. This is a strategic measure for transmitting western power to east China and for readjusting the deployment of energy resources.

### **III. The Conditions Exist To Accelerate Development of Lancang Jiang Hydropower and the Curtain Has Been Raised**

The Lancang Jiang is an international river. The middle and lower reaches of the river within Yunnan Province between Gongguoqiao and Nan'a Hekou form a course 772 km long with a drop of 882 m, and control a basin 160,000 km<sup>2</sup> in area. The long-term mean annual flow rate at the border is 2,180 m<sup>3</sup>/S and the yearly runoff is

68.8 billion m<sup>3</sup>. Eight cascade hydropower stations have been planned at Gongguoqiao, Xiaowan, Manwan, Dachaoshan, Nuozhadu, Jinghong, Ganlanba, and Nan'a Hekou with a total installed generating capacity of 13.70 million kW, a total regulated reservoir capacity of 23 billion m<sup>3</sup>, a guaranteed output capacity of 7.133 million kW, and annual power output of 70.86 billion kWh.

The main advantageous conditions for developing hydropower resources in the middle and lower reaches of the Lancang Jiang are: 1) There are excellent terrain and geological conditions, it is a narrow gorge-type reservoir, the lithology is mostly igneous and metamorphic rock, and the rock is solid and integral. It can meet the demands of dam and reservoir construction. The alluvial strata in the river bed are rather thin and little engineering is required. The amount of concrete required per kW of installed generating capacity is 0.91 m<sup>3</sup>, just 31 percent of the average figure for large- and medium-scale hydropower stations under construction throughout China during the Sixth 5-Year Plan. 2) Few people must be resettled from the flooded area. An average of 71.6 mu of land will be covered and 42.6 people resettled per 10,000 kW, equal to 16 percent and 14.8 percent of the large- and medium-sized hydropower stations under construction in China during the Sixth 5-Year Plan. 3) The runoff is rather stable and energy benefits are rather good. Replenishment by melting snow results in small variation in actual yearly runoff, generally less than two-fold. The conditions exist for building large reservoirs to regulate runoff in the upper, middle, and lower reaches, and power stations have a high guaranteed output capacity and good quality electricity, with a yearly utilization rate of more than 5,000 hours. 4) Communications are convenient and construction conditions are rather good. Highways now are being opened up to each of the cascade dam sites and all can serve as construction highways after reinforcement and transformation. Rather gentle mountain slopes or platforms can be found near all the dam sites, and they can meet construction site requirements. 5) Economic indices are superior and economic benefits are obvious. The average unit investment per kWh is only 0.231 yuan/kWh, equal to 88 percent of the average figure for large- and medium-sized hydropower stations under construction throughout China during the Sixth 5-Year Plan. 6) Much preparatory work to develop the middle and lower reaches of the Lancang Jiang has already been done and the former Ministry of Water Resources and Electric Power and Yunnan Province approved development plans and reports for this section of the river in 1987. Construction has begun at the Manwan hydropower station, and feasibility research and design work at the Dachaoshan and Xiaowan hydropower stations is now proceeding with urgency, so it can meet the requirements for continuous development of the cascade.

The Manwan hydropower station now being built will have an installed generating capacity of 1.50 million kW (1.25 million kW during the first period) and a yearly

power output of 7.884 billion kWh (6.71 billion kWh during the first period). The estimated total investment is 1.048 billion yuan, and it is China's first large-scale hydropower station built through joint ministry and provincial investments. Preparations for construction began in 1985 and work got under way in 1986. The flow was diverted in 1987, a year ahead of schedule, and it is expected to begin generating power in 1991, also a year ahead of schedule. Economic indices at the Manwan hydropower station are superior, with a unit kW investment of 697 yuan, a unit kWh investment of 0.133 yuan, and unit power generation cost of 0.0053 yuan/kWh. It has a rather strong capital accumulation and repayment potential, and the loan and interest can be repaid within 10 years under current policies. Construction of the Manwan hydropower station not only is creating experience in ministry and provincial joint investments and in full encouragement of local initiative to build large-scale hydropower stations, but it also is importing competitive mechanisms in project construction management and destroying the "iron rice bowl." Inviting bids for contractual responsibility for subprojects has assured mutual progress and improvement in construction speed and project quality. The number of employees at the construction site and the area of buildings and structures is only one-fifth that in similar projects in the past, creating experience in hydropower construction.

#### **IV. Reforming Hydropower Management Systems, Readjust Economic Policies, Organizing a Joint-Stock Company To Develop Lancang Jiang Hydropower**

In the past few years, state implementation of a shift from appropriations to loans, compensated investment utilization, and soliciting and accepting bids have led to preliminary improvements in hydropower management systems. In electric power management and administration, however, there has been no basic change in the situation of unified accounting and unified state control over income and expenditures, and there are no stable capital sources for hydropower construction, which is unfavorable to continuous cascade development of rivers and river segments.

The inspection group proposed that a joint-stock group for developing Lancang Jiang hydropower should be organized as quickly as possible. The company would be an economic entity with independent management, responsibility for its own profits and losses, a capacity for self-accumulation and self-development, and corporate status. The state would entrust the company with development authority and managerial authority over Lancang Jiang hydropower (including the trunk and tributaries). It would be under guidance by state plans, implement planning item lists, and be managed by Yunnan Province. The company would be allowed to use various routes to raise capital outside of state loan support including stock investments by other industries and regions, and it would open the window to the outside and import foreign capital and technology. The company

can be organized on the basis of the Manwan hydropower station to achieve fully "design as the soul of project construction," and it can allow participation by design units. There would be a relationship between the company and construction units of soliciting bids for contractual responsibility and an economic contractual relationship with the power grid for wholesale sales of power, serving unified regulation in the power grid. The organizational leadership of the company can lead Yunnan Province in meeting with the relevant investors in establishing a board of directors to implement a general manager responsibility system under leadership by the board of directors.

The development of the middle and lower reaches of the Lancang Jiang cannot be done without state support in the area of capital. We propose that the Manwan hydropower station be placed under company management and that its income be used as a startup fund for the company. Accumulation from Manwan could be used to build Dachaoshan, accumulation from Manwan and Dachaoshan could then be used to build Xiaowan, and so on. Based on the need to develop shipping, Ganlanba can be built concurrently to form a shipping channel between Jinghong and Nan'a Hekou. During the initial period of Lancang Jiang development, the need to link construction of the cascades can result in time differentials in capital utilization, so we hope the state will provide a limited amount of loans with interest deducted, with the company repaying the principle and interest according to schedule.

In summary, the conditions basically exist to accelerate development of hydropower resources in the middle and lower reaches of the Lancang Jiang and establish a Lancang Jiang economic development zone. We firmly believe that with state assistance, good development planning focused on electric power, and reforms in management systems, it is entirely possible to finish developing hydropower resources in the middle and lower reaches of the Lancang Jiang within 20-plus years, and it definitely would create a new road for developing western regions which is suited to China's national conditions.

(Article written by Song Yanfu [1345 1693 4395])

#### Footnote

\* More than 50 personnel were in the Lancang Jiang Basin Comprehensive Inspection Group, including: Advisors: Yu Guangyuan [0060 0342 6678], renowned economist and chairman of the China Territorial Economics Research Society, and Gao Zhiguo [7559 3112 0948], former deputy secretary of the Yunnan Provincial CCP Committee and honorary chairman of the Yunnan Province Hydroelectric Power Engineering Society; Group Leader: Chang Linhua [7022 2651 5478], former deputy chairman of the State Planning Commission and deputy leader of the State Planning Commission Consulting Group; Deputy Group Leaders: Luo Xibei [5012

6007 0554], deputy director of the China International Engineering Consulting Company and deputy chairman of the China Hydroelectric Power Engineering Society, and Zhu Kui [2612 1145], standing vice governor of Yunnan Province and chairman of the Lancang Jiang Basin Comprehensive Development Planning Commission; Secretaries: Liang Yihua [4731 4135 5478], vice chairman of the China Hydroelectric Power Engineering Society, Lei Shuxuan [7191 2885 5503], vice chairman of the China Energy Resource Research Commission, Chang Wangping [7022 3769 1627], deputy director of the China Water Conservancy Economics Research Society, Yue Shihua [1471 0013 5478], first deputy director of the Lancang Jiang Basin Comprehensive Development Planning Commission, and Yang Jianqiang [2799 0256 1730], director of the Yunnan Provincial Planning Commission; and inspection group members Yang Shouzheng [2799 1343 2973], Liu Zhaolun [0491 0340 0243], Li Wenlin [2621 2429 2651], and others.

#### Small Hydropower Stations Will Help Ease Energy Shortage

40100029c Beijing XINHUA in English 0143 GMT  
26 Jan 89

[Text] Beijing, January 26 (XINHUA)—China is to build 140 medium-size and small hydropower stations at a cost of 21.7 billion yuan to help overcome energy shortage.

Huang Yicheng, minister of energy resources, told XINHUA that the shortage of electricity has become a major problem because of the slow increase in coal production and transport difficulties.

So he is pinning his hopes on the development of medium-size and small hydropower stations which can be built quickly and at relatively small cost.

China has water resources capable of developing 378 million kilowatts of energy, but only a little more than 30 million kilowatts have been harnessed. Hydropower stations with a total capacity of 20 million kilowatts are already under construction and are expected to start operating in the 1990s.

The 140 new hydropower stations planned will be built in 24 provinces, cities and autonomous regions. They will have a total capacity of 10.3 million kilowatts.

China already has more than 63,000 small hydropower stations each with a capacity of less than 25,000 kilowatts. They supply electricity to 33 percent of the counties and 42 percent of the rural towns throughout the country.

These small hydropower stations serve the inhabitants in remote areas that the major national power networks cannot reach. Some have been developed into local networks.

According to electricity administration statistics, electricity is available to more than 500 million of the 800 million farmers in China.

**Lubuge's No 1 Generator Now Operational**

*40130055b Guiyang Guizhou Provincial Service in  
Mandarin 2300 GMT 27 Dec 88*

[Text] After 72 hours of trial operations, the first generating set of Lubuge power station, China's first hydroelectric power project using credits from the World Bank and inviting international tenders, was officially commissioned and generated electricity at 1540 yesterday [27 December 1988].

Guiyang Governor Wang Chaowen and Yunnan Governor He Zhiqiang made a special trip to Lubuge to cut ribbons for the power station. The power station is one

of China's key projects in the Sixth 5-Year Plan. In both design and construction, the hydroelectric power station adopted the method of inviting international tenders and introduced advanced technology and management methods from eight countries, including Japan, Australia, the FRG, and Norway. In so doing, it has not only cut down investments but also generated electricity 95 days ahead of schedule.

At the ribbon-cutting ceremony and the reception, on behalf of the Guiyang Provincial CPC Committee and the provincial government, Comrade Wang Chaowen conveyed his congratulations to the builders of the power station and said that the World Bank and Chinese and foreign experts were welcome to come to Guizhou to make investments and to take part in the development and construction of power stations in the Wujiang river basin.

### **Nation's First 600-Megawatt Unit Joins Grid**

40130062 Beijing ZHONGGUO JIXIE BAO in Chinese  
20 Dec 88 p 1

[Text] Hefei, 16 Dec—The first 600-megawatt thermal power generator to be built in China went into operation on 15 December at the Pingyu power plant in Anhui Province.

The manufacture of this generator is one of 12 top priority items on the State's Seventh Five-Year Plan agenda for technical equipment. Its design and manufacturing technology was imported from the United States, technology comparable to international standards of the early 1980s. The system employs computerized controls throughout and has a high level of automation; it is also fuel efficient and has excellent safety features. The completion of the unit demonstrates that China has now become one of the few countries in the world having the capability to manufacture a 600,000-kilowatt thermal generating unit.

State and Party leaders have placed great significance on the project and the construction site was visited repeatedly by leaders from the State Council, the State Planning Commission, the Ministry of Machine Building and Electronics, the Ministry of Energy Resources, and the government of Anhui Province to resolve problems.

Units involved in the manufacture and installation of the equipment include the Harbin Steam Turbine Factory, the Harbin Electrical Machinery Plant, the Harbin Boiler Works, and the Anhu No 2 Electric Power Construction Company.

### **Pingyu's 600 MW Unit On Stream**

40130054a Guangzhou NANFANG RIBAO in Chinese  
17 Dec 88 p 3

[Text] Hefei, 16 Dec—China's first 600,000-kilowatt thermal generating unit went on stream on 15 December

at the Pingyu power plant in Anhui Province. The largest generator to be built in China, the unit was one of 12 priority items under the Seventh Five-Year Plan. The design and manufacturing technologies were imported from the United States and are of the international standards of the early 1980's. The unit is computer controlled and is highly automated with an excellent margin of safety and low coal consumption. Its construction demonstrates that China has joined the ranks of the countries capable of manufacturing 600MW single unit thermal generators. It will also play a major role in alleviating the electric power shortage now being experienced in the East China Grid.

### **Wujing Expansion Project Begins**

40130048a Shanghai WEN HUI BAO in Chinese  
25 Nov 88 p 1

[Text] Work began yesterday on the sixth-stage expansion project of Shanghai's Wujing thermal power plant, a major item on the State's construction agenda. The expansion calls for the installation of two 300-kilowatt coal-fired generator sets. This is the second major power plant construction project to be started in Shanghai after the Shidongkou project. The project is being built with a World Bank loan as well as a joint investment scheme involving the State and Shanghai Municipality; the World Bank loan amounts to 190 million U.S. dollars while domestic funding totals some 450 million U.S. dollars. According to the stipulation of the contracts, the first generating set must be operational within 38 months after the contract goes into effect and be generating electricity by 22 September 1991. The second unit will be operational by 22 September 1992. At present, the Wujing power plant has an installed capacity of 350,000 kilowatts.



**Coal Output Grows Yearly But Shortages Persist**  
40130051c Guangzhou NANFANG RIBAO in Chinese  
12 Dec 88 p 3

[Text] General Manager of the China General Corporation of State-run Coal Mines Yu Hongen said today that the past 10 years have been the best for the development of China's coal industry. Coal production has increased by 300 million tons, the average annual increase has been nearly 35 million tons. In the past 5 years the average annual increase has been particularly high at 50 million tons. For 3 consecutive years from 1985 to 1987, there appeared a moderation in the coal supply and demand relationship. So far this year, the nationwide coal production situation is still good. As of the end of November, the accumulated coal output for the entire nation was 33 million tons greater than that during the same period last year. It is projected that production for the whole year will exceed last year's output by 40 million tons. He pointed out that the current reemergence of a tense coal supply and demand situation is not being caused by a fall in coal output, but rather is the result of an excessively rapid expansion of the processing industries which is greatly outstripping the rate of increase in coal production.

Yu Hongen said that in the future, the tense coal supply and demand relationship will not be a short-term, temporary situation but will persist. He appealed to those mining bureau managers attending the meeting to fully exploit those policies adopted by the State for alleviating economic pressure on coal mines, to deepen reform of enterprises, to extract internal potential, and to work hard at increasing production, so to promote the sustained, stable and healthy development of the coal industry.

When he spoke of the goals for 1989, Yu Honghe said that next year's planned coal production is 985 million tons. Of this total, 462.67 million tons are to be produced by unified distribution mines and 522.33 million tons are to come from local mines. He added that plans call for 35 mines to enter production next year, for a total planned capacity of 24.38 million tons.

**1988 Output Put at 947 Million Tons**  
40101126a Beijing CEI Database in English 11 Jan 89

[Text] Beijing (CEI)—China's total coal output reached 947.09 million tons in 1988, 5.4 percent more than last year, according to the State Statistical Bureau.

In the last month, the output of raw coal was about 95 million tons.

Shaanxi Province, the largest coal producer in China, had produced 241.54 million tons of raw coal in 1988, a 6.7 percent [increase] over 1987. Though the province turned out over one-fourth of the country's total, it had not completed its annual production plan.

**1988 Jilin Local Colliery Output Up**  
40130059c Changchun Jilin Provincial Service in Mandarin 2200 GMT 22 Jan 89

[Text] In 1988, the total coal output of local collieries of Jilin Province reached 8.4 million tons, overfulfilling the state production plan by 5 percent. The proportion of coal output of these collieries to the province's total coal output rose from 30.5 percent to 40 percent.

During the 10 years of reform, the governments at all levels throughout the province conscientiously implemented the principle of the CPC Central Committee and the State Council on pooling the efforts of large, medium-sized and small collieries in developing coal industry and encouraging the participation of the state, collective and individual sectors, changed the past method of mainly relying on state investment; developed coal resources of medium-sized and small collieries; and encouraged townships, towns, the collectives and individuals to run collieries. By the end of 1988, a total of 41 local state-run collieries were built with an annual production capacity of 4.24 million tons; and more than 1,500 township individual collieries were developed with an annual production capacity of nearly 4 million tons. This formed a coal industry pattern which integrates the state unified distribution mines with local state-run collieries and township collieries.

**Large Anthracite Field Found in Yunnan**  
40130050c Beijing CEI Database in English 20 Dec 88

[Text] Kunming (CEI)—The Yunnan Provincial Geological Department has verified a large quality anthracite coal field with geological reserves totalling 3.75 billion tons in Fuyuan County of Eastern Yunnan Province, according to local sources.

The coal field, 20 kilometers long and 10 kilometers wide, covers an area of 180 square kilometers.

It is divided in six prospecting zones. In the three zones with intensive and meticulous prospecting completed, industrial reserves of 979 million tons of anthracite have been verified, including 57.6 percent of reserves of high grade.

In the other three zones now under prospecting, reserves of anthracite are estimated at 2.7 billion tons.

The coal field boasts 13 workable coal seams containing water, lime and sulphur. One kilogram of the coal can emit 8,368 kilocalories.

Preliminary feasibility studies of relevant departments showed that a large mine capable of producing 6 to 7 million tons of coal annually can be built there.

**Mechanization Boosts Shanxi Production**

*40100027a Beijing XINHUA in English  
1526 GMT 10 Jan 89*

[Text] Taiyuan, 10 Jan (XINHUA)—Comprehensive Mechanization greatly promoted coal production last year in Shanxi Province, according to an official from the local mining bureau.

As a result of efforts to apply advanced technology, 15 mining teams last year produced over 1 million tons of raw coal, and one team produced more than 1.8 million tons of coal.

In order to promote the development of mechanized equipment for coal production, the provincial authorities have invested 200 million yuan in the state-run coal mines.

Some 62.8 percent of the coal mines in the province have installed comprehensive mechanized equipment.

State-run coal mines in the province produced more than 90 million tons of coal last year.

This year, Shanxi Province will make great efforts to develop mechanization of coal mining, especially comprehensive mechanization, said Wu Sansong, director of the Shanxi Mining Administration Bureau.

**Success in Oil Production Noted**  
*40130050d Beijing XINHUA in English*  
1517 GMT 15 Dec 88

[Text] Beijing, 15 Dec (XINHUA)—China's oil output in 1988 is expected to be 21.9 million bbls more than last year, according to the Energy Ministry. By 11 December, total oil output had reached 943.233 million bbls.

Wu Yuewen, the ministry's chief engineer of petroleum, attributed this to high output of most onshore oil fields in the fourth quarter. Many, he said, made up for lost production during the first three quarters.

Daqing oil field, the largest one in China, which lost 3.65 million bbls because of heavy floods, is still likely to fulfil its annual production target, Wu said. Liaohe, Jilin, and Jiangsu oil fields will also meet their targets.

This year's planned output for natural gas is 13.7 billion cubic meters of which 12.7 billion cu m had been produced by 30 November.

Major discoveries of oil and gas have been made in the Tarim Basin in Xinjiang Uigur Autonomous Region and in the Bohai Gulf, Wu said.

**Cooperative Effort Finds 34 Offshore Oil, Gas Structures**  
*40130051a Shanghai WEN HUI BAO in Chinese*  
26 Nov 88 p 1

[Text] Reporter Gu Longyou learned from the National Geology, Petroleum Prospecting and Resource Information Conference convened today that the cooperative offshore oil exploration between China and other countries has yielded striking results. As of now, China has completed bilateral negotiations and the first and second rounds of bidding on offshore oil exploration. Three prospecting agreements and 37 oil contracts have been signed with 45 oil companies from 12 countries including the United States, Great Britain, Japan, France, and Italy. Foreign oil companies have invested 2.17 billion U.S. dollars. As of the first half of this year, 141 preexploration wells and 58 evaluation wells had been drilled on 138 structures, and a total of 34 oil- and gas-bearing structures were located.

According to the presentation, the Liuhua 11-1 oil field, discovered through Chinese-Foreign cooperation, on the Dongsha bulge of Pearl River mouth basin in the South China Sea, contains geological reserves of nearly 200 million tons. This major discovery reveals that the bulge extending from Dongsha to Shengtu to Songtao on the continental shelf in the northern part of the South China Sea is an important place to find large oil fields. The reef oil deposits of this bulge region in particular will be major targets of exploration. Chinese-Foreign cooperative exploration of the cover structure on the western side of Hainan Island's southeastern basin discovered the Yai 13-1 gas-bearing structure. The gas-bearing area

covers 50 square kilometers, the gas column is 340 meters high and natural gas reserves are about 80 billion cubic meters. To date, this is the largest gas field discovered in China.

The cooperative development of China's offshore oil is also being smoothly initiated. The Chengbei, Bozhong 28-1 and Wei 10-3 oil fields, developed in cooperation with Japan and France, have all entered production and a substantial output has already been achieved. In addition, there are seven other offshore oil fields being developed with foreign cooperation, on which predevelopment feasibility studies and marine engineering construction preparatory work are being urgently carried out. It is estimated that this group of oil fields will enter production between 1989 and 1993.

**Bohai Corporation Has Record Output**  
*40130059e Tianjin TIANJIN RIBAO in Chinese*  
30 Dec 88 p 2

[Text] According to information released by Cao Dean, president of the Bohai Petroleum Corporation, on the morning of 29 December, the Bohai Petroleum Corporation topped 400,000 tons in output of crude oil this year, hitting a record high. Meanwhile, the corporation has yielded important results in geological prospecting. The newly added petroleum geological reserves have reached 100 million tons, making the total petroleum reserves of the corporation reach 360 million tons. In addition, the natural gas reserves now exceed 30 billion cubic meters.

**New Developments in Exploration in Beibu Wan**  
*40130047b Jiangling SHIYOU YU TIANRANQI*  
*DIZHI [OIL AND GAS GEOLOGY] in Chinese*  
Vol 9, No 3, Sep 88 p 305

[Text] The Beibu Wan Basin covers an area of 35,000 square kilometers with a water depth of less than 50 meters. This basin contains the four Lower Tertiary oil producing depressions of Weixian, Haizhong, Niaoshi, and Maichen. The oil-bearing rock covers 22,000 square kilometers at an average thickness of 500 to 700 meters. Organic material is abundant and of a good type, belonging to the good-to-best grades of oil-bearing rock.

In 1977 the Western Hainan Oil Company drilled the Wan-1 well and discovered many Tertiary positions containing oil. Starting in May 1980, exploration and development contracts were signed with a French company, Sunoco and Pennzoil of the United States and the Japanese Idemitsu Oil Company. As of the end of 1984, the Wei-10-3, Wei-11-1, Wei-11-4, Wei-12-3, and Niao-16-1 oil fields and oil-bearing formations had been discovered and verified. From 1985 to the beginning of 1987, 11 wells were drilled with foreign cooperation. None of these hit oil or gas flows and as a result some foreign oil companies backed out of the contract. It was under these circumstances that the Western Hainan Oil Company organized research personnel to resurvey and

interpret 70,000 kilometers of seismic survey lines, rere-search the production, storage, cover layer, and closure conditions of the basin and reappraise the oil and gas resources. After thorough analysis and comparison, the Weixinan depression was selected as the major object of exploration.

This depression has an area of 2,400 square kilometers. Oil-bearing rock is distributed over 1,600 square kilometers; its greatest thickness is 3,000 meters while the average thickness is 600 meters. Oil content is 6.8 billion tons. In this depression there are four rows of structures conducive to the accumulation of oil and gas and exploratory drilling can be done on 24 structures. Six have already been drilled, hitting four oil fields and oil-bearing structures. The explorations achieved a 66.7 percent success rate. Last year at the Weixinan depression, exploratory drilling on the Wei-6-1 formation discovered a carboniferous system limestone (bedrock) oil and gas reservoir. Test drilling yielded a daily production of 940,000 cubic meters of natural gas, 210 cubic meters of condensate and 206 cubic meters of crude oil. This year has again seen new progress in the exploratory drilling at the Wei-11-4 north formation. At the Lower Tertiary Shaliugang group, daily production rates of 136,000 cubic meters of natural gas and 73.8 cubic meters of condensate were obtained. Testing at the Lower Tertiary Weizhou group resulted in a daily production rate of 489 cubic meters of crude oil.

#### **Huabei Field Overfulfills Target**

40130059d Shijiazhuang HEBEI RIBAO in Chinese  
2 Jan 89 p 1

[Summary] In 1988, the crude oil output of the Huabei Oilfield was 6.12 million tons, 70,000 tons more than the state target. At the same time, this field raced against time to build new oil wells. In 1988, 149 new wells were put into production, increasing crude oil output by 280,000 tons. In 1988, this field supplied 37 million cubic meters of gas to Beijing.

#### **Western Sichuan Natural Gas Exploration Yields Major Results**

40130047c Jiangling SHIYOU YU TIANRANQI DIZHI  
[OIL AND GAS GEOLOGY] in Chinese  
Vol 9, No 3, Sep 88 p 313

[Text] During the past 2 years, natural gas exploration in Western Sichuan has made important accomplishments in two fields.

1. A complex fissure-type gas reservoir has been discovered in the upper Shaximiao group Jurassic located in the Deyang and Xiaoquan regions. The fissured sandstone, alternating layers of sandstone and mudstone and the mudstone all yielded natural gas. The depth is 1,500 to 2,000 meters and the highest unobstructed flow rate exceeds 100,000 cubic meters per day. Several industrial gas wells have already begun production. This type of gas reservoir has the following characteristics: 1) The gas

source comes from the Upper Triassic Xujiahe group reaching the high pressure gas source rock. The fourth and fifth Xu sections of the upper part of the Xujiahe group contain a 600-meter thick dark mudstone layer rich in organic matter. The gas source rock is at least 500 to 1,000 meters from the Upper Shaximiao group. The gas is forced upward under great pressure through small rifts, cracks, and fissures until it encounters a tight sealing cap, then it flows into the holes and fissures of the reservoir body. 2) The gas reservoir rock is extremely dense and nonhomogenous. Its effective porosity is only 2 to 7 percent and the penetration coefficient of the rock matrix is generally less than  $0.1 \times 10^{-3} \mu\text{m}^2$ . Only with a developed fissure network can industrially producible energy be formed. 3) The gas reservoir is not controlled by an anticlinal trap, but rather by a fissure trap. Fissure traps have been discovered in all of the deflected, bent, and twisted parts outside of the anticlinal trap. 4) An approximately 300-meter-thick layer of Suining mudstone constitutes the regional cap layer. However, a complete seal is not possible. Under the conditions of great differences in pressure and density, some natural gas will continue to migrate upwards and diffuse. Because the hydrocarbon production rate of the organically rich rock of the Xujiahe group exceeds or equals the rate of loss through the above mentioned diffusion, the Upper Shaximiao group beneath the Suining group can still maintain excessive pressure. The highest pressure gradient reaches 21.6 KPa/m. 5). Gas and small amounts of condensate are produced, while water is not produced.

2. After completed well testing on Chuanhe-100, the first exploratory well in Deyang's Hexing field anticline, a middle output industrial gas flow was obtained in the second section of the Xujiahe group in the Upper Triassic series. Under a flow pressure at the well bottom of 69 MPa (absolute), production is 129,000 cubic meters per day and the unobstructed flow is over 300,000 cubic meters per day. Test extraction was begun on 1 July of this year. The reservoir is fissured-porous type sandstone and contains low water, pure gas reserves under high pressure with the pressure gradient reaching 17 KPa/m.

This well was constructed by the Southwest Petroleum Geology Bureau of the Ministry of Geology and Mineral Resources in joint cooperation with American companies. Well depth reached 5,430 meters with drilling passing through the entire Upper Triassic series. Well construction period was 283 days and engineering quality is excellent. It has provided valuable experience in deep well exploratory drilling in Western Sichuan. In the process of drilling and completing the well, a great deal of geological and geophysical information was obtained in addition to information on natural gas indications in many shallow, intermediate, and deep layers. This provides a basis for discoveries of gas deposits in the second Xu section and the three dimensional multilayer exploration and development of the Hexing field formation. It also provides very valuable enlightenment concerning the industrial exploration of the middle section of the

Western Sichuan Depression (from Mianyang to Dayi). Therefore, this important well is considered another major discovery following the discovery of the Zhongba gas field.

#### **Preparatory Work Underway on Huge Sichuan Gas Field**

40130051b Chengdu SICHUAN RIBAO in Chinese  
14 Nov 88 p 1

[Text] The huge reserves of the Moxi gas field have already been verified and work preparatory to gas field development is being urgently carried out. Yesterday Provincial Governor Zhang Haoruo stressed that accelerated development of the Central Sichuan gas fields is a major task for Sichuan. Each department and local government throughout the province must cooperate in a concerted effort and give full support in every way possible to the fulfillment of construction requirements.

The natural gas output of Sichuan ranks number one nationwide. Southern and Southwestern Sichuan are steady, longstanding gas producing regions and Eastern Sichuan in recent years has abruptly become a factor, with production steadily on the rise. However, although Central Sichuan is generally considered by the geological community to be a large oil and gas region with many oil reservoirs, repeated efforts beginning in 1958 have left these expectations unrealized. Discovery of a major oil and gas region has remained beyond reach.

In September 1988 the State Reserves Commission specially examined and approved the Moxi oil and gas reserves report. They firmly believe that this gas field is among the most valuable of all the newly discovered oil- and gas-bearing regions worldwide. The natural gas deposit newly added the first half of this year, located in the central section of the Moxi gas field, by itself represents 165 percent of the year's reserves planned for verification throughout the entire province and one-half that planned for entire country.

The verified reserves of the Moxi gas field have already, astonishingly, placed it in the number three ranking provincially. Two layers in the deep section and two horizontal wings still have great potential. A point even more worthy of emphasis is that in the process of exploration, the many relationships between holes and fissures, deep layers and shallow layers, structured deposit gas and nonstructured deposit gas, sandstone and carboniferous stone have resulted in new breakthrough concepts with significance for the overall situation and the value of wide applicability. In accordance with the development program proven at the Moxi gas field, within 3 years an annual production capacity of several hundred million cubic meters will be created at the Moxi Lei-1 gas deposit which stretches on a line between Suining, Boxi, and Tongnan and has an area of 120 square kilometers. This not only enhances Sichuan's long history of natural gas development, it provides

timely alleviation of the province's current power shortage situation. Particularly important is that the first phase of the project, planned for construction during the first quarter of next year, will guarantee the natural gas raw material required for the entry into production of Sichuan's two large chemical fertilizer plants. Thus, it will directly increase the effective supply of natural gas for the vigorous development of Sichuan's agriculture and economy, generating huge benefits.

#### **Jiangsu Fields Taking Shape**

40130054b Shanghai JIEFANG RIBAO in Chinese  
4 Dec 88 p 3

[Text] Nanjing, 3 December—The Jiangsu oil fields, under construction for the last 10 years, are now taking shape. According to the latest statistics, they have to date produced some 4.739 million tons of oil and 279 million cubic meters of natural gas. So far, the Jiangsu oil fields have discovered 21 oil- and gas-bearing structures and have built 15 oil fields. Impressive deposits of both oil and natural gas have also been verified. Today, these fields can supply the state with more than 700,000 tons of crude oil and last year's production outstripped that of the Yumen fields.

#### **High-output Petroleum Area Found in Jilin**

40130047a Jiangling SHIYOU YU TIANRANQI  
DIZHI [OIL AND GAS GEOLOGY] in Chinese  
Vol 9, No 3, Sep 88 p 287

[Text] The Yitong fault-depressed basin stretches 150 kilometers from north to south, is 10 to 20 kilometers wide, and covers an area of 2,400 square kilometers. Its basement is from 1,200 to 6,000 meters deep.

Here, in March 1985 the Ministry of Coal Industry discovered, at Chaluhe hole 85-3, at a depth of 58.8 to 1000.34 meters, heavy oil sand (level 18, 31.94 meters). In 1984, the Jilin Oil Field Administration Bureau began seismic surveys, and detailed investigations, opened 9 exploratory wells and discovered widespread indications of oil and gas. In March 1988 at the Wuxing formation in Shuangyang County a high-output oil flow was obtained from the Chang-10 well. This well hit, in the Lower Tertiary at a depth of 1787.2 to 1918.6 meters, a three-layer oil reservoir 37 meters thick. After blasting open only the lower 10.6-meter level a daily production of 145 tons and 17,600 cubic meters of natural gas was obtained at a static pressure of 189.1 atm and a flow pressure of 157 atm. The specific gravity of the crude oil is 0.8389, viscosity of 4.64 mpa.s, the solidification point is 25°C, bitumen content is 2.48 percent, colloidal material content is 15.6 percent, paraffin content is 13.32 percent, sulphur content is 0.08 percent and the fore-running point is 72°C. The specific gravity of the natural gas is 0.8896, its nitrogen content is 0.8 percent, CO<sub>2</sub> content 0.66 percent, methane content 63.8 percent, ethane content 12.9 percent, propane content 13.1 percent, isobutane content 3.35 percent and n-butane content 3.38 percent. Reservoir material: Based on 71

samples, average porosity is 15 percent, the penetration coefficient is  $264 \times 10^{-3} \mu\text{m}^2$ , carbonate content is 1.3 percent and argillite content is 8.5 percent.

### The Role of Tarim in China's Petroleum Development

40130036 Hong Kong LIAOWANG [OUTLOOK] in Chinese No 46, 14 Nov 88 pp 8-9

[Article by Miao Qing [5379 7230]: "Tarim and China's Petroleum Development"]

[Text] In 1988 the China Petroleum and Natural Gas Corporation's Geophysics Bureau entered its 10th year of oil and gas exploration in Xinjiang's Tarim Basin.

What are the results of 10 years of exploration? Chai Guilin [2693 2710 2651], chief geologist with the Geophysics Bureau, told reporters that exploration results have confirmed that the Tarim Basin has the basic geological conditions for the formation of large oil and gas fields, and that it is the most hopeful reserve base area for the development of China's petroleum industry.

#### I. Inadequate Reserves

Compared to the world average, the ratio between reserves and exploration in China's petroleum industry is rather low and reserves have grown at a rate far below the rate of growth in crude oil output.

There are two main reasons for the loss of balance between reserves and exploration:

The first is rising investment costs to prove reserves in the last few years and the fact that exploratory drilling fell far behind plans, resulting in declining new additions to proven reserves each year. The investment to prove each 100 million tons of reserves was up by 175.7 percent in 1986 and 186.5 percent in 1987 compared to the state's Sixth 5-Year Plan. This directly affected completion of exploratory drilling and reserve verification plans.

The second is that although the east China region is a focus of reserves and output and has great potential resources in the short term, particularly the Bohai Bay Basin, the types of oil pools tend to be very complex, making it increasingly difficult to find new petroleum reserves.

To reverse the imbalance between reserves and exploration, state policymaking departments have clarified that stronger prospecting work in east China should be combined with exploration and development in west China. The relevant authorities feel that China's marine and northwestern regions, particularly the large Tarim sedimentary basin in Xinjiang, are the sources of hope for China's petroleum industry reserve base areas.

The Tarim Basin has poor surface conditions, difficult communications and transportation, and places high technical demands on exploration, but it is more favorable than marine petroleum exploration and development with their long schedules, consumption of enormous resources, even higher technical requirements, and other problems. This gives people greater hopes for the Tarim Basin.

#### II. An Enigma

Realities in petroleum exploration and development in China and the world have confirmed that basins are essential for petroleum. The amount of petroleum reserves are directly proportional to the size of a basin's area. The part of the Tarim Basin which lies within Xinjiang's borders covers an area of 560,000 km<sup>2</sup>. Added to the part of it within western Gansu, Dunhuang Basin, the total area is almost 700,000 km<sup>2</sup>, making it China's largest continental shelf. Before the 1980s, however, this basin remained an enigma to mankind. Chinese and foreign petroleum experts have indicated that the Tarim Basin is the world's only large petroliferous basin which has not been explored in detail.

Chief geologist Chai Guilin said that, before Liberation, most who had been to the middle part of Tarim, particularly the Taklimakan Desert, were a few adventurers and geological workers. The range of their activity was mainly around the margins of the desert and they obtained only a limited number of results. After Liberation, the Xinjiang Petroleum Management Bureau of the former Ministry of Petroleum Industry did a very limited amount of gravity and magnetic prospecting in the central part of the Taklimakan Desert. Although they gained an understanding of the basin as a whole, they still lacked a clear understanding of the oil and gas-bearing characteristics of the Tarim Basin.

The Tarim Basin has seen three high tides of petroleum exploration since the 1950's:

In 1957, the Yiqikelike oil pool was discovered in the Baicheng region at the southern edge of Tian Shan. The former Ministry of Petroleum Industry organized personnel and drilling rigs for a mass campaign, but the complexity of underground structures led to miniscule end results, with the wells drilled producing less than 10,000 tons of crude oil a year. The first high tide passed quickly.

The second high tide came in 1977. The Xinjiang Petroleum Management Corporation at the time discovered the Keya oil pool in the Yecheng region. The geological conditions of this oil pool were good, with the Kegan well alone producing almost 1,000 tons of crude oil and 1 million m<sup>3</sup> of natural gas daily, which was much more encouraging. As a result, the former Ministry of Petroleum Industry organized a mass campaign

around Kekeya to expand the exploration results, but the complexity of geological conditions led to less than ideal results in the mass campaign.

People's experiences over 30 years made them realize that correct evaluation of the oil and gas-bearing characteristics of the entire Tarim Basin requires a detailed seismic exploration of the region covered by desert. This is essential to understanding the formation and development of the entire Tarim Basin, selecting the best well sites in the best regions, and obtaining the optimum economic results. This in turn aroused the third high tide. Since 1983, China and the United States have jointly explored the Taklimakan Desert. In 5 years, several 10 seismic profiles were done, and eventually modernized science and technology were used to open the underground geological palace of mysteries, giving people a preliminary view of its primitive and true features.

### III. A Cornucopia Rich in Petroliferous Anomalies

Chief geologist Chai Guilin said that detailed exploration of the desert areas of the Tarim Basin combined with prospecting data from regions along its rim have provided a clear understanding of underground geological structures in the entire Tarim Basin:

1. Geologically speaking, the Tarim Basin has a basic structural framework of several large uplifts and large downwarps. In most situations, oil and gas are generated in depressions and later migrate into structures within uplifted areas. The Tarim Basin's basic structural framework of several large uplifts and depressions has given it the fundamental conditions for oil generation and accumulation. Tarim Basin's bedrock is buried at great depths, it is a compound-type petroliferous basin with several marine facies and continental facies oil-generating strata systems, and it is extremely rich in oil sources.

2. The target strata in the search for large oil and gas fields in the Tarim Basin are mainly from the Paleozoic era. The Tarim Basin also has several main oil-generating strata systems. The oil generating strata systems in the previously discovered Yiqikelike oil pool and Kekeya oil pool are both from the Mesozoic, and this strata system is widely distributed throughout the basin, so it often is the case that the Mesozoic is assumed to be the main exploration target strata system within the basin. However, the results of new exploration have confirmed that enormously thick Paleozoic strata are found throughout the basin. This has been confirmed by the eruption of the Shacan No 2 well and the rather good oil and gas indications seen at the Luntai No 1 and Lunnan No 2 wells. Paleozoic strata are very thick, accounting for one-half of the oil-generating strata systems which produce oil and gas. This has made them the primary target in the search for large oil and gas pools in the Tarim Basin.

3. The Tarim Basin contains large oil reservoiring structures. After oil is generated in subsided regions, it requires the existence of "oil reservoirs." These are called "oil reservoiring structures." In the absence of oil reservoiring structures, most of the oil and gas generated can escape. In Hebei Province's Huabei [North China] oil field, for example, the Baiyangdian depression and Hejian depression are oil generating regions, while the Renqiu ancient buried hill zone is a large oil reservoir. The oil and gas generated in the Baiyangdian and Hejian depressions must migrate along certain pathways to Renqiu before it can be extracted. Seismic work has provided preliminary proof of a series of large and small oil reservoiring structures on several large uplifts in the Tarim Basin, with an entrapment area of some of the large structures in excess of 1,000 km<sup>2</sup>. A large area of non-structural traps also has been discovered. These several categories of traps in the Tarim Basin are just like many conventional oil reservoirs. They confirm that this basin is a favorable region for the formation of large or super-large oil and gas accumulations.

Chief geologist Chai Guilin felt that a major breakthrough in oil and gas exploration in the Tarim Basin is just a matter of time. Success could greatly alleviate the passive situation of a serious loss of balance in China's petroleum industry, and it could have a major effect on the development of oil and gas resources in the Xinjiang region and on economic development policies in north-west China.

**Hopes High for Big Oil, Gas Finds in Tarim**  
40100027b Beijing XINHUA in English  
1322 GMT 10 Jan 89

[Text] Beijing, 10 Jan (XINHUA)—China will invest up to 1.5 billion yuan in the next 2 years in a large-scale oil exploration and development program in the Tarim Basin in the Xinjiang Uygur Autonomous Region, north-west China.

Addressing a national meeting on the oil industry, Wang Tao, general manager of the China National Oil and Gas Corporation, said that the corporation hopes to find a large oil and gas field in the basin.

He said the corporation plans to shoot 20,000 kilometers of seismic lines and sink more than 50 exploratory wells.

Wang said that his corporation will assemble 13 seismic crews in addition to the seven currently working in the basin, and nine drilling teams in addition to the eight already working there, as well as other geological and construction teams.

**High-Producing Northern Tarim Well Reported**  
40130057 Beijing RENMIN RIBAO in Chinese  
1 Dec 88 p 1

[Text] According to CHINA PETROLEUM NEWS, on 17 November the Lunnan-2 well in the center of the northern bulge of the Tarim [Basin] hit large amounts of oil and gas and by the 26th, daily production was 682 cubic meters of crude and 110,000 cubic meters of natural gas.

Drilling of the Lunnan-2 well began in April 1988 and when completed the depth had reached 5,221 meters. During the drilling of the well, equally good oil and gas indications were found at Zhuluoxi and Sandiexi respectively with the oil layer having a thickness of 60.5 meters and the oil-water layer having a thickness of 29 meters.

Since last year, the Southern Xinjiang Petroleum Exploration Company has sunk five exploratory wells, including three that have hit commercial-grade oil flows.



**'Newly Discovered' Fault Said No Threat to Daya Bay**

40100030 Hong Kong *HONGKONG STANDARD* in English 27 Jan 89 p 3

[Article by Esme Lau and Tammy Tam]

[Text] Chinese authorities have been aware of an alleged seismic fault near the Daya Bay Nuclear Power Plant for more than 10 years, an official of the State Seismology Bureau said yesterday.

The effect of the fault line, which is within 7 kilometers of the plant, was taken into consideration in two separate studies before construction started.

"The fault was pointed out in a map on the [movement of major rock formations] in the country," said Mr Lin Musun, head of the general office of the state bureau.

The map was edited in 1978 and initially circulated to departments concerned for reference, he said.

The Guangdong Seismology Bureau, which was assigned to conduct a geological feasibility study for the nuclear power plant, said it received information on the fault when working on the study more than 2 years ago.

"After more than 2 years" thorough investigation on the area, we were assured that the faults would not lead to major earthquakes," said Mr Xiao, an official in the Information Department of the Guangdong Bureau.

A geology lecturer at the Hong Kong Polytechnic, Mr Maurice Atherton, pointed out yesterday that the fault line ran up the Daipeng Peninsula within 7 kilometers of the plant and was shown in several recent Chinese maps.

Mr Atherton said the fault had been described as "weakly active."

A senior lecturer in the Department of Civil and Structural Engineering, Mr Atherton said this contradicted the claim by the Hong Kong Nuclear Investment Company that "no active fault was present within an 8 kilometers radius of the plant"—in accordance with the U.S. regulations that no plant should be built so close to a fault.

When told the *HONGKONG STANDARD* was informed by Beijing that they were aware of the fault 10 years ago, Mr Atherton said: "In that case, they must know about it. But according to the power company, it has never been told about it and yet they got the licence in 1987."

His actions, he said, were designed to prompt an explanation for the discrepancy although there was no call for Hong Kong [residents] to overreact.

"There is no immediate danger because the plant will not be loaded with radioactive material until 1992," he said.

According to his calculation there is a 1-in-15 chance of an earthquake which could cause damage to the plant within its 40-year working life.

The discovery of this fault line did not necessarily alter the estimates, he said, adding that there might not be release of radiation even if there was structural damage to the plant.

Mr Xiao said a standard earthquake-resistance plan for the Daya Bay plant had been drawn up.

"One point people should understand is that seismic faults exist in many places. That is a very common geological phenomenon," he said.

Meanwhile, the State Seismology Bureau was informed about the "newly discovered" fault on Wednesday by the Guangdong Nuclear Power Joint Venture Company.

Professor Ma Xingyuan, chief editor of the map, said despite seismic faults in Guangdong Province and Hong Kong, he didn't see "any possible danger of a future earthquake."

**Daya Bay Back-up Pumped-Storage Station Contracts Signed**

40100029d Beijing *CEI Database* in English 26 Jan 89

[Text] Guangzhou (CEI)—Guangzhou recently signed contracts with Alsthom Company and Elecricite de France to import equipment and technology for the building of a pumped-storage station.

The station, with high hydrodynamic heads and a large storage capacity, is to be built for the security of Daya Bay nuclear power station and for the regulation of power valleys and peaks in the Guangdong network.

The project, started in 1988, costs 1.4 billion yuan, including a 200-million-U.S.-dollar loan from the French Government. The first unit is expected to generate electricity in 1992 and the whole project will be accomplished in 1994.

**300 MW Unit for Qinshan**

40130048b Shanghai *WEN HUI BAO* in Chinese 23 Nov 88 p 1

[Summary] The first 300,000-kilowatt steam turbine for a nuclear power plant to be designed and built in China was completed yesterday by the Shanghai Steam Turbine Plant, creating a new chapter in the nation's power plant equipment manufacture. This nuclear power generating steam turbine will be the first unit to be installed at the Qinshan nuclear power plant, China's first nuclear power facility. The overall length of the steam turbine is 26 meters, its width 6 meters, and its height 11 meters. Experts responsible for its inspection are convinced of the turbine's outstanding quality with blade tolerances held to less than half the width of a human hair, equal to the most advanced international standards.

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